CLAIMS:

1. A cell element of a laminated cell array for the electrowinning of metal from metal ion solutions, comprising an anode shell and a cathode shell separated by an insulating diaphragm, the anode shell delimited by an anodic plate provided with at least one conductive protrusion for transmitting direct electric current to an anode, the cathode shell delimited by a cathodic plate and provided with at least one draft tube capable of establishing a spouted bed of metallic beads, said diaphragm being provided with perforations in correspondence of said spouted bed of metallic beads allowing the free circulation of the electrolyte while hindering the passage of said metallic beads from the cathode compartment to the anode compartment.

2. The cell element of claim 1 wherein said at least one conducting protrusion is shaped as a rib.

3. The cell element of claim 2 wherein said ribs have a first major surface whereto said anode is secured, and a second major surface provided with a contact strip, said contact strip being welded to said anodic plate.

4. The cell element of claims 2 or 3 wherein said anode shell further comprises rib-shaped spacers.

5. The cell element of the previous claims wherein said cathode shell is constructed from an array of bars.

6. The cell element of claim 5 wherein said bars are rectangular-shaped.

7. The cell element of the previous claims wherein said cathode shell comprises at least one window for inspection.

8. The cell element of the previous claims wherein said anode shell and said cathode shell comprise peripheral flat regions such as frames or flanges for fastening said anode shell to said cathode shell.

9. The cell element of the previous claims wherein said anode shell is made of titanium or an alloy thereof, and said cathode shell is made of stainless steel, nickel or titanium.

10. The cell element of claim 9 wherein said anode is a foraminous titanium structure coated with noble metals or noble metal oxides on at least one surface thereof.

11. The cell element of claims 9 or 10 wherein said anode shell is put in contact with the cathode shell of the adjacent cell element in the cell array with at least one bimetallic strip interposed therebetween.

12. The cell element of claim 11 wherein said at least one bimetallic strip is welded to at least one of said cathode shell and said anode shell.

13. The cell element of claim 12 wherein said at least one bimetallic strip is welded to said anode shell in correspondence of said at least one conducting protrusion.

14. The cell element of claim 13 wherein said at least one bimetallic strip and said at least one conducting protrusion are welded to said anode shell in a single step.

15. The cell element of the previous claims wherein said insulating diaphragm forms a full face gasket contributing to the hydraulic seal between said anode shell and said cathode shell at least in the peripheral portion thereof.

16. The cell element of claim 15 wherein said insulating diaphragm is provided with an additional insulating mask in correspondence of the regions contacting the outer edges of said anode and /or the vertical edges of said at least one draft tube.

17. The cell element of the previous claims wherein said insulating diaphragm is made of a woven fabric.

18. The cell element of claim 17 wherein said fabric is woven as a plain or as a reverse Dutch weave.

19. The cell element of claim 18 wherein said fabric has a ratio of weft wire to warp wire diameter comprised between 1.15 and 1.5.

20. The cell element of claim 19 wherein said fabric has a ratio of weft wire to warp wire diameter of about 5:4.

21. The cell element of claims 17 to 20 wherein the ratio of warp wire spacing to warp wire diameter is greater than 3.

22. The cell element of claims 17 to 21 wherein said woven fabric has a thickness comprised between 0.4 and 0.6 mm.

23. The cell element of claims 17 to 22 wherein said fabric is a polyester fabric.

24. The cell element of claim 10 wherein said insulating diaphragm is obtained by applying an insulating coating to the surface of said foraminous titanium anode opposed to said at least one surface coated with noble metals or noble metal oxides.

25. The cell element of claim 24 wherein said insulating coating is a ceramic coating.

26. The cell element of claim 25 wherein said ceramic coating is selected from the group consisting of valve metal oxides and silicon carbide.

27. The cell element of claim 26 wherein said ceramic coating is applied by plasma spraying.

28. The cell element of claim 24 wherein said insulating coating comprises a fluorinated polymeric material.

29. The cell element of the previous claims wherein said at least one draft tube is a rectangular-shaped tube.

30. The cell element of claim 29 wherein said rectangular-shape tube is made of a corrosion resistant metal, preferably stainless steel or titanium.

31. The cell element of claim 30 wherein said metallic rectangular-shaped tube is provided with an insulating outer coating and/or with foam tape at least on the two major surfaces thereof parallel to said anodic plate and said cathodic plate.

32. The cell element of claims 29 to 31 wherein the depth of said rectangular shaped tube is equivalent to the distance between said cathodic plate delimiting said cathode shell and said diaphragm.

33. The cell element of claims 29 to 32 wherein the bottom of said at least one draft tube is provided with an enlarged entry with respect to the tube width.

34. The cell element of claims 29 to 33 wherein said at least one draft tube is provided with arrowhead shaped elements located in its lower part, the angle

thereof with the horizontal being comprised between 60 and 80° and preferably equivalent to about 70°.

35. The cell element of the previous claims wherein said at least one draft tube comprises a base provided with at least one nozzle for feeding the electrolyte, thereby generating a motion capable of establishing said spouted bed of metallic beads.

36. The cell element of claim 35 wherein said at least one nozzle is a double nozzle comprising an outer portion located at the base of the cell and an inner portion extending within or near the entrance of said at least one draft tube.

37. The cell element of claim 35 or 36 wherein said inner portion of the double nozzle is provided with perforations allowing the passage of electrolyte and hindering the passage of said metallic beads.

38. The cell element of the previous claims further comprising at least one deflector placed over the top of said at least one draft tube suitable for controlling the height of said spouted bed.

39. The cell element of claim 38 wherein said at least one deflector is generally rooftop-shaped.

40. The cell element of claims 38 or 39 wherein said at least one deflector is provided with holes allowing the free passage of electrolyte and hindering the passage of said metallic beads.

41. The cell element of the preceding claims further provided with a bead over-flow system comprising at least one weir placed at an adjacent height to the top of said at least one draft tube and a tank for collecting the over-flowed beads.

42. The cell element of claim 41 wherein said tank is provided with means for discharging said over-flowed beads from the bottom.

43. The cell element of claim 41 or 42 wherein said tank has a cone-shaped bottom.

44. The cell element of the previous claims further comprising an electrolyte drain tube provided with a filter element allowing the discharge of the electrolyte from the cell while preventing the discharge of said metallic beads.

45. The cell element of the previous claims further comprising a bead drain device for discharging said metal beads therefrom provided with a drainage tube and a Tee-shaped separation element fed with electrolyte in the horizontal leg thereof.

46. An array of stacked electrowinning cell elements each comprising an anode shell delimited by an anodic plate and a cathode shell delimited by a cathodic plate and including a draft tube establishing a spouted bed of metal beads, said anodic plate contacting the cathodic plate of the adjacent cell in the array.

47. The array of claim 46 wherein said anodic plate contacts said cathodic plate of said adjacent cell by means of a bimetallic contact strip.

48. The array of claims 46 or 47 wherein said anode shell and said cathode shell of each cell element are mutually fastened before stacking the cell elements.

49. The array of claims 46 to 48 wherein the cell elements are cell elements of claims 1 to 45.

50. A method for the electrowinning of a metal comprising feeding metallic beads in the cathodic compartment of a cell element of claims 1 to 45, putting said beads in electrical contact with said cathodic plate, and engaging said beads subjected to a cathodic potential in a spouted bed under the action of a metal ion bearing electrolyte supplied through said at least one draft tube.

51. The method of claim 50 wherein said spouted bed is formed by at least one bead filled generally rectangular-shaped annulus disposed on one side of said at least one draft tube.

52. The method of claim 50 wherein said spouted bed is formed by two bead filled generally rectangular-shaped annuli disposed on the opposite sides of said at least one draft tube.

53. The method of claim 51 or 52 wherein said two bead filled rectangular-shaped annuli allow the self-formation of moving cones of beads filling the lower corners of said cathode shell and allowing the natural formation of bead flow channels into the vertical gap below the base of said at least one draft tube.

54. The method of claims 50 to 53 wherein said metal to be electrowon is selected from the group consisting of copper, tin, manganese, zinc, nickel, chromium and cobalt.

55. A cell element of a laminated cell array for the electrowinning of metal comprising the distinctive elements of the description and the figures.